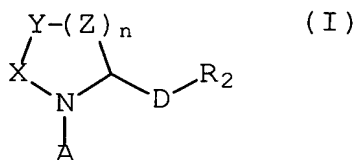


WHAT IS CLAIMED IS:

1. A compound of formula (I):



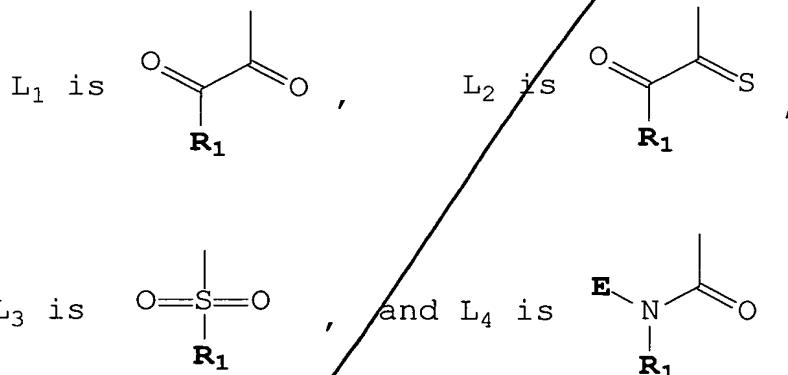
where

5 X, Y, and Z are independently selected from the group consisting of C, O, S, or N, provided that X, Y, and Z are not all C;

n is 1-3;

A is selected from the group consisting of L₁, L₂, L₃, or L₄,

where



R₁ and E are independently selected from the group consisting of hydrogen, C₁-C₉ straight or branched chain alkyl or alkenyl, C₂-C₉ straight or branched chain alkenyl, aryl, heteroaryl, carbocycle, and heterocycle;

D is selected from the group consisting of a bond, C₁-C₁₀ straight or branched chain alkyl, ethylene, and butylene;

R₂ is a carboxylic acid or a carboxylic acid isostere; wherein said alkyl, alkenyl, alkynyl, aryl, heteroaryl, carbocycle, heterocycle, or carboxylic acid isostere is optionally substituted with one or more substituents selected from R³, where

R³ is hydrogen, hydroxy, halo, haloalkyl, thiocarbonyl, alkoxy, alkenoxy, alkylaryloxy, aryloxy, arylalkyloxy, cyano,

nitro, imino, alkylamino, aminoalkyl, sulfhydryl, thioalkyl, alkylthio, sulfonyl, C₁-C₆ straight or branched chain alkyl, C₂-C₆ straight or branched chain alkenyl or alkynyl, aryl, heteroaryl, carbocycle, heterocycle, or CO₂R⁴ where R⁴ is hydrogen or C₁-C₉ straight or branched chain alkyl or alkenyl;

or a pharmaceutically acceptable salt, ester, or solvate thereof;

provided that:

R₁ is not substituted with both hydroxy and oxygen to form carboxy, or R₁ is not substituted with both alkoxy and oxygen to form alkoxy carbonyl, or R₁ is not substituted with both amine and oxygen to form amide;

further provided that:

when A is L₁ or L₂, and D is a bond, then R₂ is not COOH, or an amide;

further provided that:

when A is L₁, and R₁ is methyl, and D is a bond, then R₂ is not COOH;

further provided that:

when A is L₃, and R₁ is phenyl, methylphenyl, phenylmethyl, substituted or unsubstituted phenoxyphenyl, substituted naphthyl, or methoxyphenyl, and D is a bond, then R₂ is not COOH or an amide;

further provided that:

when A is L₃, and R₁ is phenyl, and D is a bond, then R₂ is not thiophenyl;

further provided that:

when A is L₃, and R₁ is phenyl, and D is oxyethyl, then R₂ is not an amide;

further provided that:

when A is L₃, and R₁ is substituted isoquinoline, and D is butyl,

then R₁ is not an amide;

further provided that:

when A is L_3 or L_4 , and R_1 is unsubstituted or substituted phenyl, and D is C_1 - C_3 alkyl or alkenyl, then R_2 is not $COOH$, OH , or an amide;

further provided that:

when A is L_4 , and R_1 is phenyl, halo-substituted phenyl, dimethylphenyl, substituted butyl, or methylphenyl, and D is a bond,

then R_2 is not $COOH$;

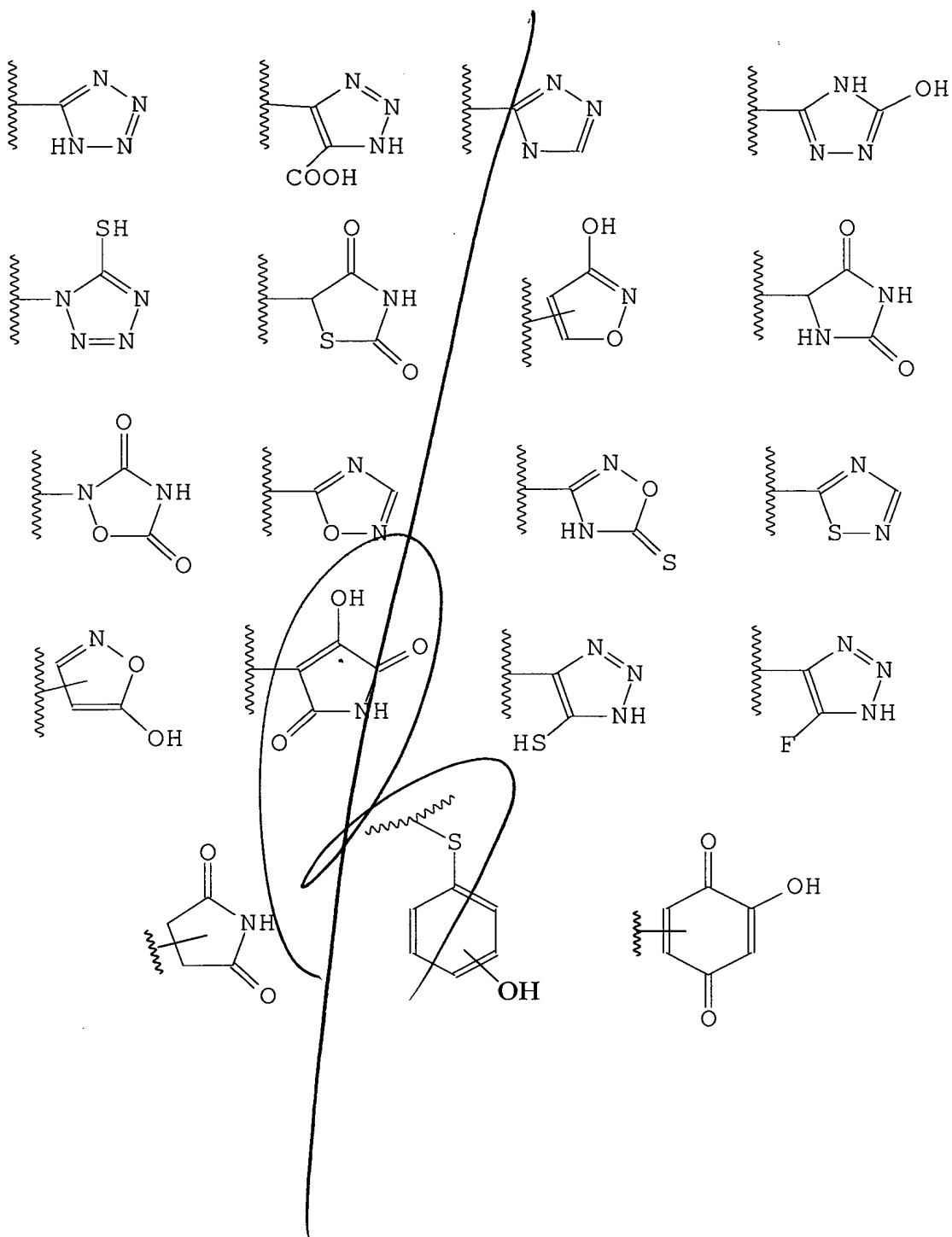
further provided that:

when A is L_4 , and R_1 is cyano-substituted alkyl, and D is a bond,

then R_2 is not an amide

2. The compound of claim 1, wherein the carboxylic acid isostere of R_2 is a carbocycle or heterocycle containing any combination of CH_2 , C , CH , O , S , or N in any chemically stable oxidation state, wherein any of the atoms of said ring structure are optionally substituted in one or more positions with R^3 .

3. The compound of claim 1, wherein R_2 is selected from the following group:

[illegible]

where the atoms of said ring structure may be optionally substituted at one or more positions with R^3 .

4. The compound of claim 1, wherein the carboxylic acid or carboxylic acid isostere of R_2 is selected from the group consisting of:

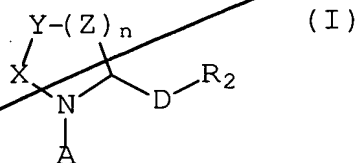
$-\text{COOH}$, $-\text{SO}_3\text{H}$, $-\text{SO}_2\text{HNR}^3$, $-\text{PO}_2(\text{R}^3)_2$, $-\text{CN}$, $-\text{PO}_3(\text{R}^3)_2$, $-\text{OR}^3$, $-\text{SR}^3$, $-\text{NHCOR}^3$, $-\text{N}(\text{R}^3)_2$, $-\text{CON}(\text{R}^3)_2$, $-\text{CONH}(\text{O})\text{R}^3$, $-\text{CONHNHSO}_2\text{R}^3$, $-\text{COHNSO}_2\text{R}^3$, and $-\text{CONR}^3\text{CN}$.

5. The compounds, (2S)-1-(phenylmethyl) carbamoyl-2-hydroxymethyl (4-thiazolidine); (2S)-1-(1,1-dimethylpropyl)carbamoyl-2-(4-thiazolidine)tetrazole; (2S)-1-(phenylmethyl) carbamoyl-2-(4-thiazolidine) carbonitrile; (2S)-1-(1,1-dimethylpropyl)carbamoyl-2-(4-thiazolidine)tetrazole; 3-(3,3-dimethyl-2-oxopentanoyl)-1,3-oxazolidine-4-carboxylic acid; and (2S)-1-(3,3-dimethyl 1,2-dioxopropyl)-2-(3-thiazolidine)carboxylic acid..

6. A pharmaceutical composition, comprising:

- an effective amount of a carboxylic acid or carboxylic acid isostere of an N-heterocyclic ring compound having two or more heteroatoms in the ring; and
- a pharmaceutically acceptable carrier.

7. The pharmaceutical composition of claim 6, wherein the carboxylic acid or carboxylic acid isostere of an N-heterocyclic ring compound having two or more heteroatoms in the ring comprises a compound of formula (I):



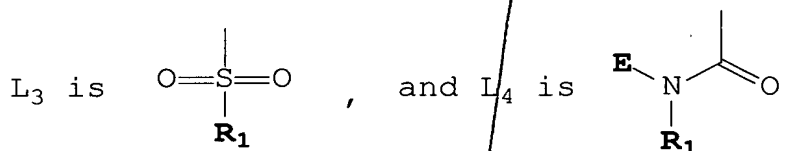
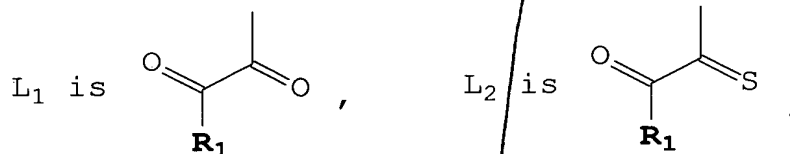
where

X, Y, and Z are independently selected from the group

consisting of C, O, S, or N, provided that X, Y, and Z are not all C;

n is 1-3;

A is selected from the group consisting of L₁, L₂, L₃, or L₄, where



R₁ and E are independently selected from the group consisting of hydrogen, C₁-C₉ straight or branched chain alkyl or alkenyl, C₂-C₉ straight or branched chain alkenyl, aryl, heteroaryl, carbocycle, and heterocycle;

D is selected from the group consisting of a bond, C₁-C₁₀ straight or branched chain alkyl, ethylene, and butylene;

R₂ is a carboxylic acid or a carboxylic acid isostere;

wherein said alkyl, alkenyl, alkynyl, aryl, heteroaryl, carbocycle, or heterocycle is optionally substituted with one or more substituents selected from R³, where

R³ is hydrogen, hydroxy, halo, haloalkyl, thiocarbonyl, alkoxy, alkenoxy, alkylaryloxy, aryloxy, arylalkyloxy, cyano, nitro, imino, alkylamino, aminoalkyl, sulfhydryl, thioalkyl, alkylthio, sulfonyl, C₁-C₆ straight or branched chain alkyl, C₂-C₆ straight or branched chain alkenyl or alkynyl, aryl, heteroaryl, carbocycle, heterocycle, or CO₂R⁴ where R⁴ is hydrogen or C₁-C₉ straight or branched chain alkyl or alkenyl;

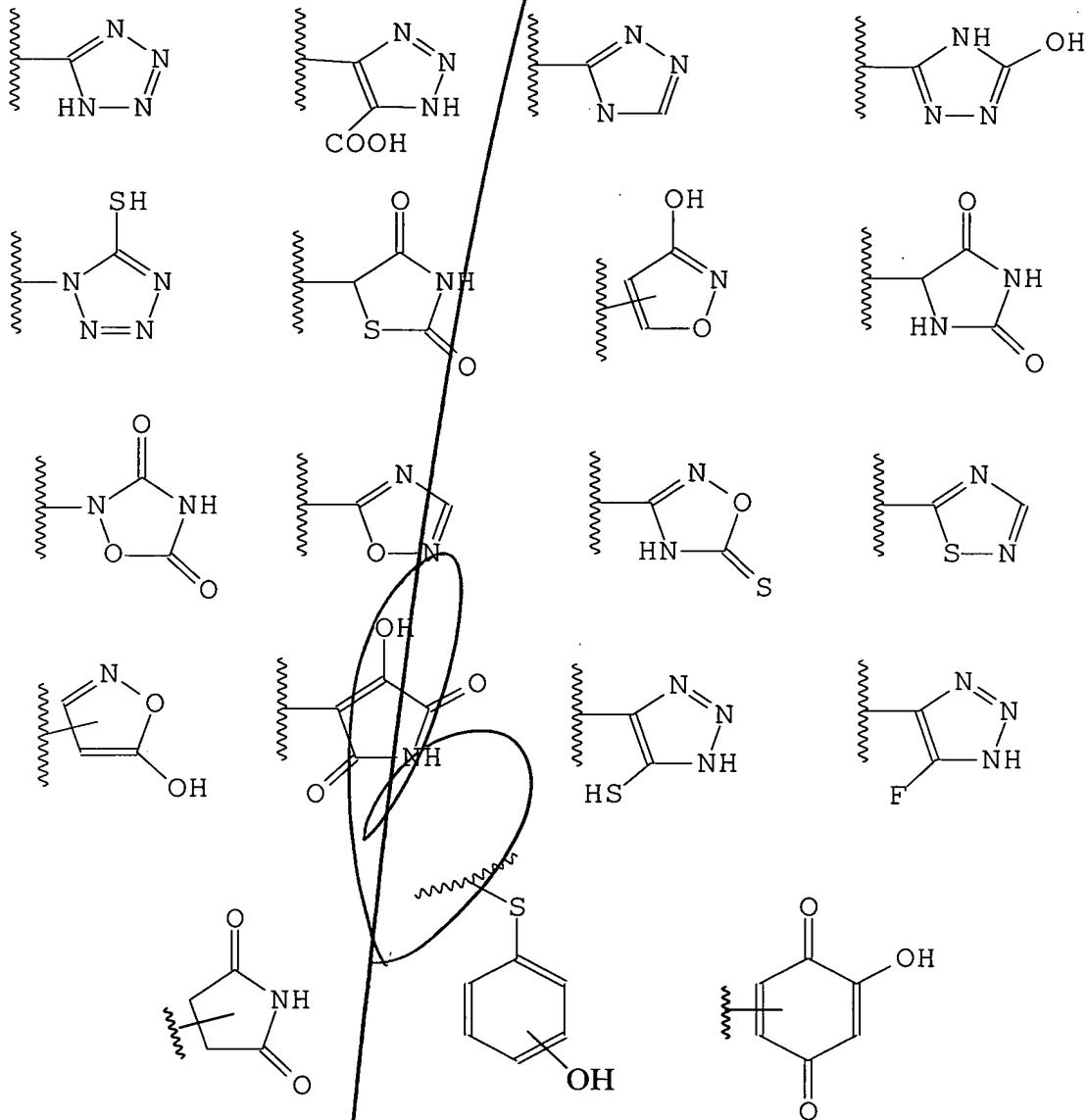
or a pharmaceutically acceptable salt, ester, or solvate thereof.

8. The pharmaceutical composition of claim 7, wherein R₂

is a carbocycle or heterocycle containing any combination of CH_2 , O, S, or N in any chemically stable oxidation state, wherein any of the atoms of said ring structure are optionally substituted in one or more positions with R^3 .

5

9. The pharmaceutical composition of claim 7, wherein R_2 is selected from the following group:



where the atoms of said ring structure may be optionally substituted at one or more positions with R³.

10. The pharmaceutical composition of claim 7, wherein R₂ is selected from the group consisting of:

-COOH, -SO₃H, -SO₂HNR³, -PO₂(R³)₂, -CN, -PO₃(R³)₂, -OR³, -SR³,
-NHCOR³, -N(R³)₂, -CON(R³)₂, -CONH(O)R³, -CONHNHSO₂R³,
-COHNSO₂R³, and -CONR³GN.

11. The pharmaceutical composition of claim 7, wherein the carboxylic acid or carboxylic acid isostere of an N-heterocyclic ring compound having two or more heteroatoms in the ring is selected from the group consisting of compounds 1-442, compound L, and compound M.

~~12. The pharmaceutical composition of claim 6, further comprising a neurotrophic factor different from formula (I).~~

~~13. The pharmaceutical composition of claim 12, wherein said neurotrophic factor different from formula (I) is selected from neurotrophic growth factor, brain derived growth factor, glial derived growth factor, ciliary neurotrophic factor, insulin growth factor and active truncated derivatives thereof, acidic fibroblast growth factor, basic fibroblast growth factor, platelet-derived growth factors, neurotrophin-3 and neurotrophin 4/5.~~

14. A method of treating a neurological disorder in an animal, comprising:

administering to the animal an effective amount of a carboxylic acid or carboxylic acid isostere of an N-heterocyclic ring compound having two or more heteroatoms in the ring to stimulate growth of damaged peripheral nerves or to promote neuronal regeneration.

15. The method of claim 14, wherein the neurological disorder is selected from the group consisting of peripheral neuropathies cause by physical injury or disease state, physical damage to the brain, physical damage to the spinal cord, stroke associated with brain damage, and neurological disorders relating to neurodegeneration.

16. The method of claim 14, wherein the neurological disorder is selected from the group consisting of Alzheimer's Disease, Parkinson's Disease, and amyotrophic lateral sclerosis.

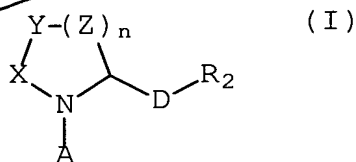
17. The method of claim 14, wherein the neurological disorder is Alzheimer's disease.

18. The method of claim 14, wherein the neurological disorder is Parkinson's disease.

19. The method of claim 14, wherein the neurological disorder is amyotrophic lateral sclerosis.

20. The method of claim 14, wherein the carboxylic acid or carboxylic acid isostere of an N-heterocyclic ring compound having two or more heteroatoms in the ring is non-immunosuppressive.

21. The method of claim 14, wherein the carboxylic acid or carboxylic acid isostere of an N-heterocyclic ring compound having two or more heteroatoms in the ring comprises a compound of formula (I):



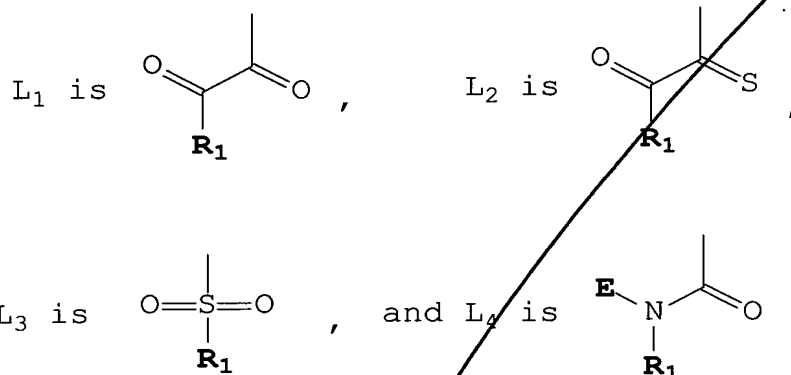
where

X, Y, and Z are independently selected from the group consisting of C, O, S, or N, provided that X, Y, and Z are not all C;

n is 1-3;

5 A is selected from the group consisting of L₁, L₂, L₃, or L₄,

where



10 R₁ and E are independently selected from the group consisting of hydrogen, C₁-C₉ straight or branched chain alkyl or alkenyl, C₂-C₉ straight or branched chain alkenyl, aryl, heteroaryl, carbocycle, and heterocycle;

D is selected from the group consisting of a bond, C₁-C₁₀ straight or branched chain alkyl, ethylene, and butylene;

15 R₂ is a carboxylic acid or a carboxylic acid isostere; wherein said alkyl, alkenyl, alkynyl, aryl, heteroaryl, carbocycle, or heterocycle is optionally substituted with one or more substituents selected from R³, where

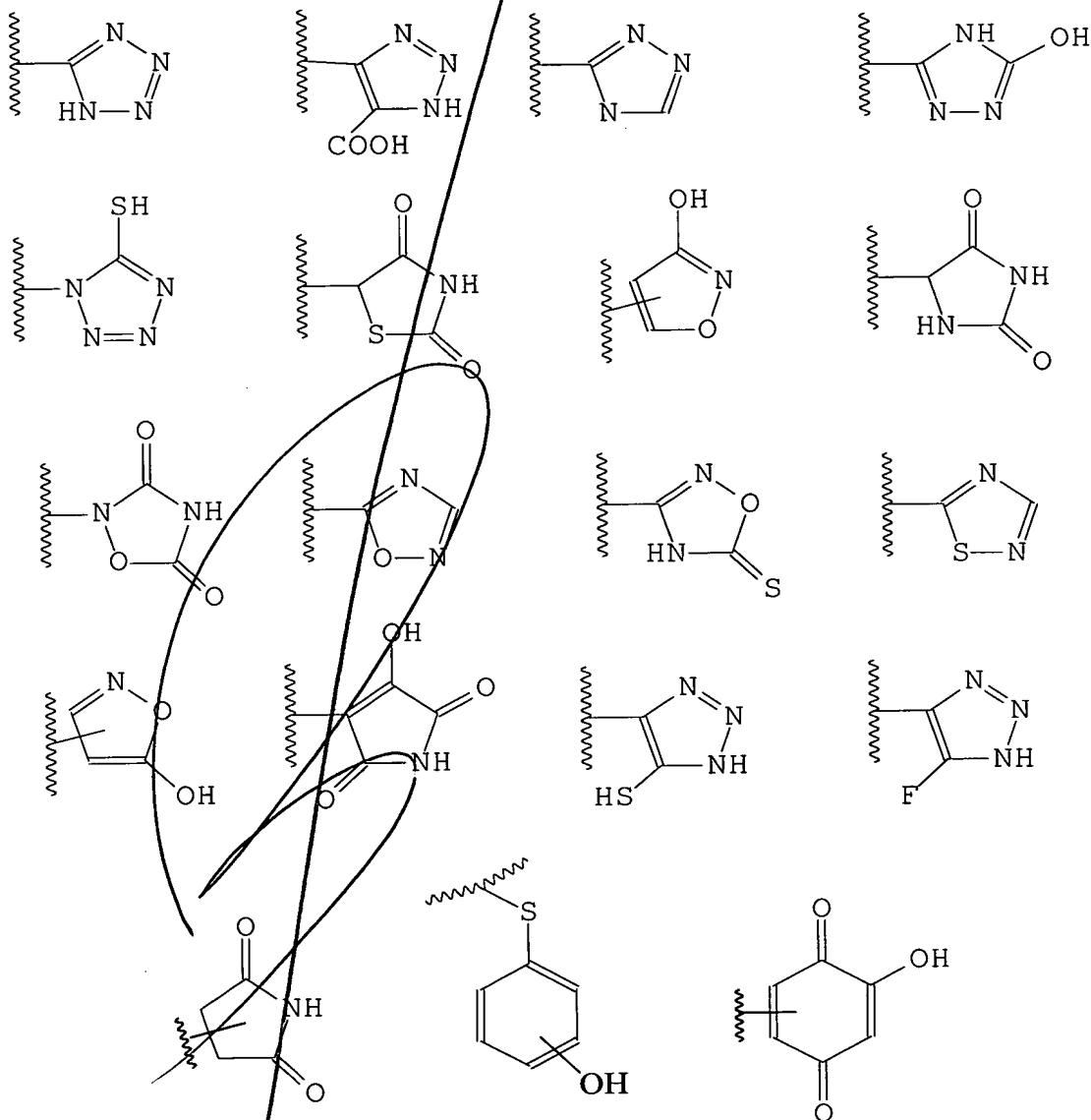
20 R³ is hydrogen, hydroxy, halo, haloalkyl, thiocarbonyl, alkoxy, alkenoxy, alkylaryloxy, aryloxy, arylalkyloxy, cyano, nitro, imino, alkylamino, aminoalkyl, sulfhydryl, thioalkyl, alkylthio, sulfonyl, C₁-C₆ straight or branched chain alkyl, C₂-C₆ straight or branched chain alkenyl or alkynyl, aryl, heteroaryl, carbocycle, heterocycle, or CO₂R⁴ where R⁴ is 25 hydrogen or C₁-C₉ straight or branched chain alkyl or alkenyl;

or a pharmaceutically acceptable salt, ester, or solvate thereof.

5

22. The method of claim 21, wherein R_2 is a carbocycle or heterocycle containing any combination of CH_2 , O, S, or N in any chemically stable oxidation state, wherein any of the atoms of said ring structure are optionally substituted in one or more positions with R^3 .

23. The method of claim 21, wherein R_2 is selected from the following group:



where the atoms of said ring structure may be optionally substituted at one or more positions with R^3 .

24. The method of claim 21, wherein R_2 is selected from the group consisting of:

-COOH, -SO₃H, -SO₂HNR³, -PO₂(R³)₂, -CN, -PO₃(R³)₂, -OR³, -SR³, -NHCOR³, -N(R³)₂, -CON(R³)₂, -CONH(O)R³, -CONHNHSO₂R³, -COHNSO₂R³, and -CONR³ON.

25. The method of claim 14, wherein the carboxylic acid or carboxylic acid isostere of an N-heterocyclic ring compound having two or more heteroatoms in the ring is selected from the group consisting of compounds 1-442, compound L, and compound M.

~~26. The method of claim 14, further comprising administering a neurotrophic factor different from formula (I).~~

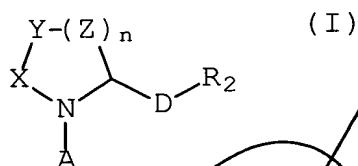
27. The method of claim 26, wherein said neurotrophic factor different from formula (I) is selected from the group consisting of neurotrophic growth factor, brain derived growth factor, glial derived growth factor, ciliary neurotrophic factor, insulin growth factor and active truncated derivatives thereof, acidic fibroblast growth factor, basic fibroblast growth factor, platelet-derived growth factors, neurotrophin-3, and neurotrophin 4/5.

~~28. A method of stimulating growth of damaged peripheral nerves, comprising:~~

~~administering to damaged peripheral nerves an effective amount of a carboxylic acid or carboxylic acid isostere of an N-heterocyclic ring compound having two or more heteroatoms in the ring to stimulate or promote growth of the damaged peripheral nerves.~~

29. The method of claim 28, wherein the carboxylic acid or carboxylic acid isostere of an N-heterocyclic ring compound having two or more heteroatoms in the ring is non-immunosuppressive.

30. The method of claim 28, wherein the carboxylic acid or carboxylic acid isostere of an N-heterocyclic ring compound having two or more heteroatoms in the ring comprises a compound of formula (I):



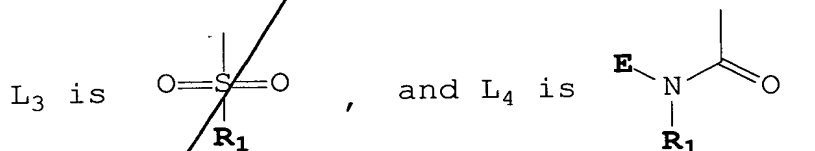
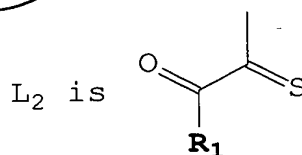
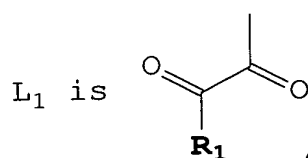
where

X, Y, and Z are independently selected from the group consisting of C, O, S, or N, provided that X, Y, and Z are not all C;

n is 1-3;

A is selected from the group consisting of L₁, L₂, L₃, or L₄,

where



R₁ and E are independently selected from the group consisting of hydrogen, C₁-C₉ straight or branched chain alkyl or alkenyl, C₂-C₉ straight or branched chain alkenyl, aryl, heteroaryl, carbocycle, and heterocycle;

D is selected from the group consisting of a bond, C₁-C₁₀ straight or branched chain alkyl, ethylene, and butylene;

R₂ is a carboxylic acid or a carboxylic acid isostere; wherein said alkyl, alkenyl, alkynyl, aryl, heteroaryl, carbocycle, or heterocycle is optionally substituted with one or more substituents selected from R³, where

R³ is hydrogen, hydroxy, halo, haloalkyl, thiocarbonyl, alkoxy, alkenoxy, alkylaryloxy, aryloxy, arylalkyloxy, cyano, nitro, imino, alkylamino, aminoalkyl, sulfhydryl, thioalkyl, alkylthio, sulfonyl, C₁-C₆ straight or branched chain alkyl, C₂-C₆ straight or branched chain alkenyl or alkynyl, aryl, heteroaryl, carbocycle, heterocycle, or CO₂R⁴ where R⁴ is hydrogen or C₁-C₉ straight or branched chain alkyl or alkenyl;

or a pharmaceutically acceptable salt, ester, or solvate thereof.

31. The method of claim 30, wherein R₂ is a carbocycle or heterocycle containing any combination of CH₂, O, S, or N in any chemically stable oxidation state, wherein any of the atoms of said ring structure are optionally substituted in one or more positions with R³.

32. The method of claim 30, wherein R₂ is selected from the following group:

The image displays a collection of chemical structures for various nucleobases and nucleosides, arranged in a grid. A large diagonal line is drawn across the structures, and a circle is drawn around the central structures.

The structures include:

- Purines:** Adenine (top left), Guanine (top center), Cytosine (top right), and Uracil (middle right).
- Pyrimidines:** Thymine (middle left), Cytosine (middle center), Uracil (middle right), and Guanine (bottom right).
- Nucleosides:** Adenosine (bottom left), Guanosine (bottom center), and Cytidine (bottom right).
- Other structures:** A structure with a carboxylic acid group (top center), a structure with a hydroxyl group (top right), a structure with a thiol group (middle left), a structure with a carbonyl group (middle center), a structure with a carbonyl group (middle right), a structure with a carbonyl group (bottom left), a structure with a carbonyl group (bottom center), and a structure with a carbonyl group (bottom right).

where the atoms of said ring structure may be optionally substituted at one or more positions with R^3 .

33. The method of claim 30, wherein R_2 is selected from the group consisting of:

-COOH, -SO₃H, -SO₂HNR³, -PO₂(R³)₂, -CN, -PO₃(R³)₂, -OR³, -SR³, -NHCOR³, -N(R³)₂, -CON(R³)₂, -CONH(O)R³, -CONHNHHSO₂R³, -COHNSO₂R³, and -CONR³CN.

34. The method of claim 28, wherein the carboxylic acid or carboxylic acid isostere of an N-heterocyclic ring compound having two or more heteroatoms in the ring is selected from the group consisting of compounds 1-442, compound L, and compound M.

35. The method of claim 28, further comprising administering a neurotrophic factor different from formula (I).

36. The method of claim 35, wherein said neurotrophic factor different from formula (I) is selected from the group consisting of neurotrophic growth factor, brain derived growth factor, glial derived growth factor, ciliary neurotrophic factor, insulin growth factor and active truncated derivatives thereof, acidic fibroblast growth factor, basic fibroblast growth factor, platelet-derived growth factors, neurotrophin-3, and neurotrophin 4/5.

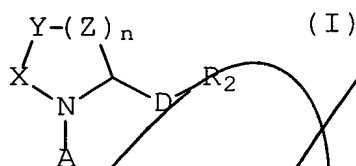
37. A method for promoting neuronal regeneration and growth in animals, comprising:

administering to an animal an effective amount of a carboxylic acid or carboxylic acid isostere of an N-heterocyclic ring compound having two or more heteroatoms in the ring to promote neuronal regeneration.

38. The method of claim 37, wherein the carboxylic acid or

carboxylic acid isostere of an N-heterocyclic ring compound having two or more heteroatoms in the ring is non-immunosuppressive.

39. The method of claim 37, wherein the Carboxylic acid or carboxylic acid isostere of an N-heterocyclic ring compound having two or more heteroatoms in the ring comprises a compound of formula (I):



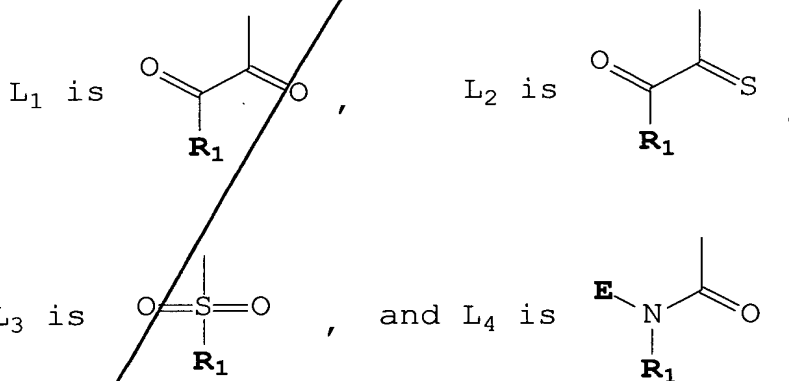
where

X, Y, and Z are independently selected from the group consisting of C, O, S, or N, provided that X, Y, and Z are not all C;

n is 1-3;

A is selected from the group consisting of L₁, L₂, L₃, or L₄,

where



R₁ and E are independently selected from the group consisting of hydrogen, C₁-C₉ straight or branched chain alkyl or alkenyl, C₂-C₉ straight or branched chain alkenyl, aryl, heteroaryl, carbocycle, and heterocycle;

D is selected from the group consisting of a bond, C₁-C₁₀ straight or branched chain alkyl, ethylene, and butylene;

R₂ is a carboxylic acid or a carboxylic acid isostere;

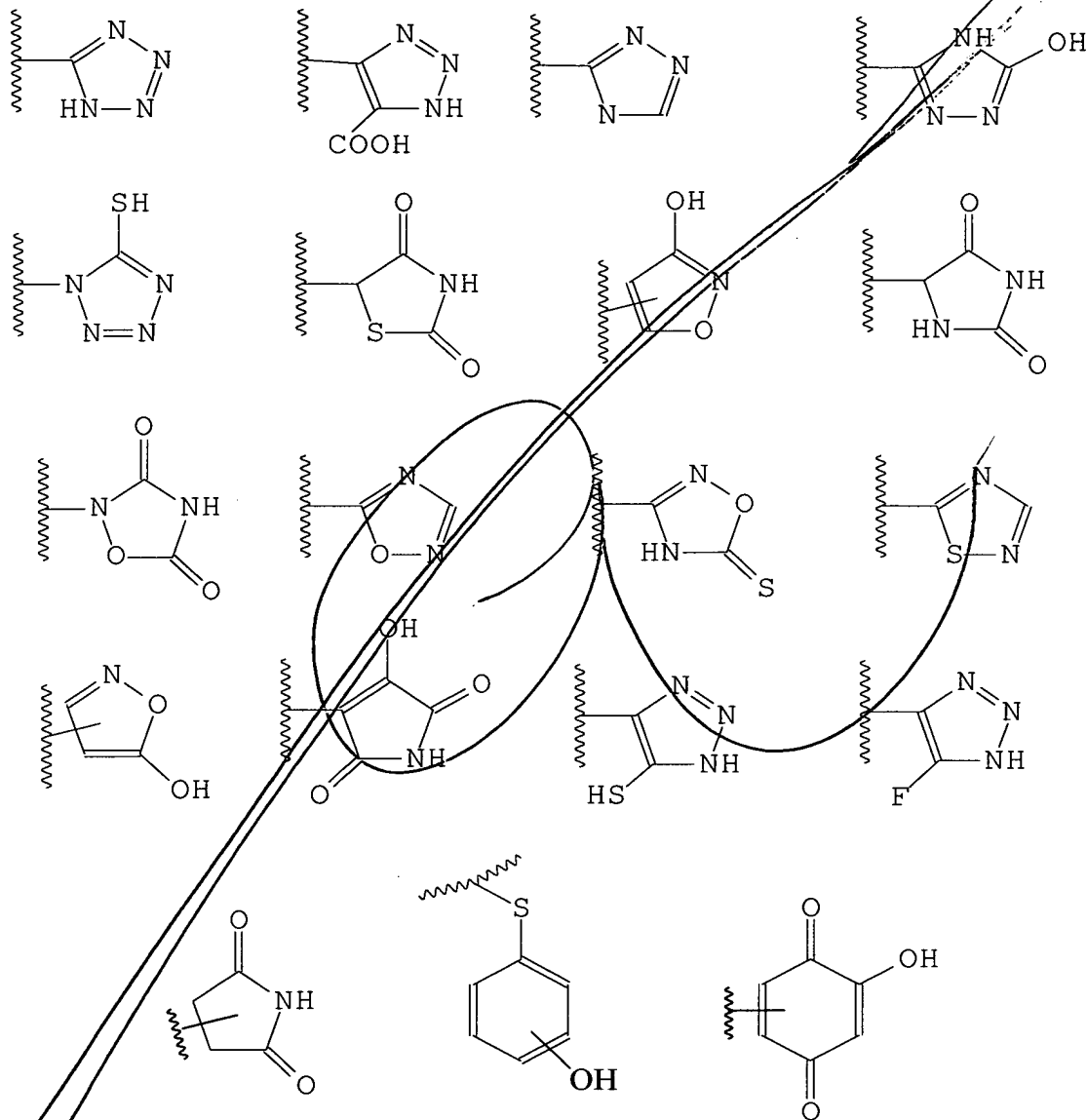
wherein said alkyl, alkenyl, alkynyl, aryl, heteroaryl, carbocycle, or heterocycle is optionally substituted with one or more substituents selected from R³, where

R³ is hydrogen, hydroxy, halo, haloalkyl, thiocarbonyl, alkoxy, alkenoxy, alkylaryloxy, aryloxy, arylalkyloxy, cyano, nitro, imino, alkylamino, aminoalkyl, sulfhydryl, thioalkyl, alkylthio, sulfonyl, C₁-C₆ straight or branched chain alkyl, C₂-C₆ straight or branched chain alkenyl or alkynyl, aryl, heteroaryl, carbocycle, heterocycle, or CO₂R⁴ where R⁴ is hydrogen or C₁-C₉ straight or branched chain alkyl or alkenyl;

or a pharmaceutically acceptable salt, ester, or solvate thereof.

40. The method of claim 39, wherein R₂ is a carbocycle or heterocycle containing any combination of CH₂, O, S, or N in any chemically stable oxidation state, wherein any of the atoms of said ring structure are optionally substituted in one or more positions with R³.

41. The method of claim 39, wherein R₂ is selected from the following group:



where the atoms of said ring structure may be optionally substituted at one or more positions with R^3 .

42. The method of claim 39, wherein R_2 is selected from the group consisting of:

-COOH, -SO₃H, -SO₂HNR³, -PO₂(R³)₂, -CN, -PO₃(R³)₂, -OR³, -SR³, -NHCOR³, -N(R³)₂, -CON(R³)₂, -CONH(O)R³, -CONHNH₂SO₂R³, -COHNSO₂R³, and -CONR³CN.

43. The method of claim 37, wherein the N-heterocyclic carboxylic acid compound is selected from the group consisting of compounds 1-442, compound L, and compound M.

44. The method of claim 37, further comprising administering a neurotrophic factor different from formula (I).

45. The method of claim 44, wherein said neurotrophic factor different from formula (I) is selected from the group consisting of neurotrophic growth factor, brain derived growth factor, glial derived growth factor, ciliary neurotrophic factor, insulin growth factor and active truncated derivatives thereof, acidic fibroblast growth factor, basic fibroblast growth factor, platelet-derived growth factors, neurotrophin-3, and neurotrophin 4/5.

46. A method for preventing neurodegeneration in an animal, comprising:

administering to an animal an effective amount of a carboxylic acid or carboxylic acid isostere of an N-heterocyclic ring compound having two or more heteroatoms in the ring to prevent neurodegeneration.

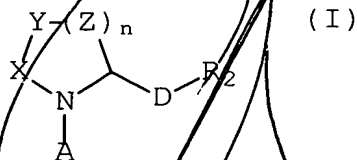
47. The method of claim 46, wherein the neurodegeneration is Alzheimer's disease.

48. The method of claim 46, wherein the neurodegeneration is Parkinson's disease.

49. The method of claim 46, wherein the neurodegeneration is amyotrophic lateral sclerosis.

50. The method of claim 46, wherein the carboxylic acid or carboxylic acid isostere of an N-heterocyclic ring compound having two or more heteroatoms in the ring is non-immunosuppressive.

51. The method of claim 46, wherein the carboxylic acid or carboxylic acid isostere of an N-heterocyclic ring compound having two or more heteroatoms in the ring comprises a compound of formula (I):



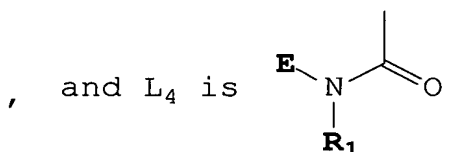
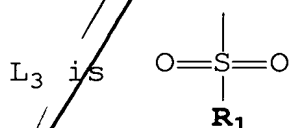
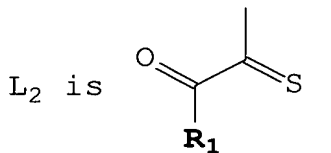
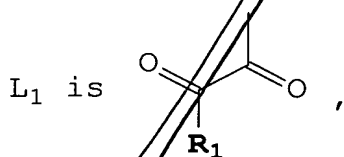
where

X, Y, and Z are independently selected from the group consisting of C, O, S, or N, provided that X, Y, and Z are not all C;

n is 1-3;

A is selected from the group consisting of L₁, L₂, L₃, or L₄,

where



R₁ and E are independently selected from the group consisting of hydrogen, C₁-C₉ straight or branched chain alkyl or alkenyl, C₂-C₉ straight or branched chain alkenyl, aryl, heteroaryl, carbocycle, and heterocycle;

5 D is selected from the group consisting of a bond, C₁-C₁₀ straight or branched chain alkyl, ethylene, and butylene;
R₂ is a carboxylic acid or a carboxylic acid isostere;

10 wherein said alkyl, alkenyl, alkynyl, aryl, heteroaryl, carbocycle, or heterocycle is optionally substituted with one or more substituents selected from R³, where

R³ is hydrogen, hydroxy, halo, haloalkyl, thiocarbonyl, alkoxy, alkenoxy, alkylaryloxy, aryloxy, arylalkyloxy, cyano, nitro, imino, alkylamino, aminoalkyl, sulfhydryl, thioalkyl, alkylthio, sulfonyl, C₁-C₆ straight or branched chain alkyl, C₂-C₆ straight or branched chain alkenyl or alkynyl, aryl, heteroaryl, carbocycle, heterocycle, or CO₂R⁴ where R⁴ is hydrogen or C₁-C₉ straight or branched chain alkyl or alkenyl;

20 or a pharmaceutically acceptable salt, ester, or solvate thereof.

52. The method of claim 51, wherein R₂ is a carbocycle or heterocycle containing any combination of CH₂, O, S, or N in any chemically stable oxidation state, wherein any of the atoms of said ring structure are optionally substituted in one or more positions with R³.

53. The method of claim 51, wherein R₂ is selected from the following group:

The image displays a collection of chemical structures for various heterocyclic compounds, primarily purines and pyrimidines, arranged in a grid. A diagonal line runs from the top right to the bottom left, and a large oval encircles a central group of structures.

- Top Row:**
 - Structure 1: A purine derivative with a wavy line at the 9-position.
 - Structure 2: A pyrimidine-2,4,6-trione derivative with a wavy line at the 5-position and a COOH group at the 6-position.
 - Structure 3: A purine derivative with a wavy line at the 9-position.
 - Structure 4: A purine derivative with a wavy line at the 9-position and an OH group at the 6-position.
- Second Row:**
 - Structure 5: A pyrimidine-2,4,6-trione derivative with a wavy line at the 5-position and an SH group at the 6-position.
 - Structure 6: A pyrimidine-2,4,6-trione derivative with a wavy line at the 5-position and a carbonyl group at the 6-position.
 - Structure 7: A purine derivative with a wavy line at the 9-position and an OH group at the 6-position.
 - Structure 8: A pyrimidine-2,4,6-trione derivative with a wavy line at the 5-position and an NH group at the 6-position.
- Third Row:**
 - Structure 9: A purine derivative with a wavy line at the 9-position and a carbonyl group at the 6-position.
 - Structure 10: A purine derivative with a wavy line at the 9-position and a carbonyl group at the 6-position.
 - Structure 11: A purine derivative with a wavy line at the 9-position and a carbonyl group at the 6-position.
 - Structure 12: A purine derivative with a wavy line at the 9-position and a carbonyl group at the 6-position.
- Fourth Row:**
 - Structure 13: A purine derivative with a wavy line at the 9-position and a carbonyl group at the 6-position.
 - Structure 14: A purine derivative with a wavy line at the 9-position and a carbonyl group at the 6-position.
 - Structure 15: A purine derivative with a wavy line at the 9-position and a carbonyl group at the 6-position.
 - Structure 16: A purine derivative with a wavy line at the 9-position and a carbonyl group at the 6-position.
- Bottom Row:**
 - Structure 17: A purine derivative with a wavy line at the 9-position and a carbonyl group at the 6-position.
 - Structure 18: A purine derivative with a wavy line at the 9-position and a carbonyl group at the 6-position.
 - Structure 19: A purine derivative with a wavy line at the 9-position and a carbonyl group at the 6-position.
 - Structure 20: A purine derivative with a wavy line at the 9-position and a carbonyl group at the 6-position.

where the atoms of said ring structure may be optionally substituted at one or more positions with R³.

54. The method of claim 51, wherein R₂ is selected from the group consisting of:

-COOH, -SO₃H, -SO₂HNR³, -PO₂(R³)₂, -CN, -PO₃(R³)₂, -OR³, -SR³, -NHCOR³, -N(R³)₂, -CON(R³)₂, -CONH(O)R³, -CONHNH₂SO₂R³, -COHNSO₂R³, and -CONR³CN.

55. The method of claim 46, wherein the carboxylic acid or carboxylic acid isostere of an N-heterocyclic ring compound having two or more heteroatoms in the ring is selected from the group consisting of compounds 1-442, compound L, and compound M.

56. The method of claim 46, further comprising administering a neurotrophic factor different from formula (I).

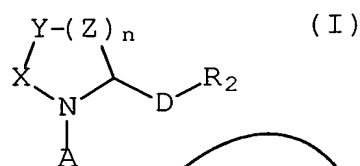
57. The method of claim 56, wherein said neurotrophic factor different from formula (I) is selected from the group consisting of neurotrophic growth factor, brain derived growth factor, glial derived growth factor, ciliary neurotrophic factor, insulin growth factor and active truncated derivatives thereof, acidic fibroblast growth factor, basic fibroblast growth factor, platelet-derived growth factors, neurotrophin-3, and neurotrophin 4/5.

58. A method for treating alopecia or promoting hair growth in an animal, which comprises administering to said animal an effective amount of a carboxylic acid or carboxylic acid isostere of an N-heterocyclic ring compound having two or more heteroatoms in the ring.

59. The method of claim 58, wherein the carboxylic acid or

carboxylic acid isostere of an N-heterocyclic ring compound having two or more heteroatoms in the ring is non-immunosuppressive.

60. The method of claim 58, wherein the carboxylic acid or carboxylic acid isostere of an N-heterocyclic ring compound having two or more heteroatoms in the ring is a compound of formula (I):



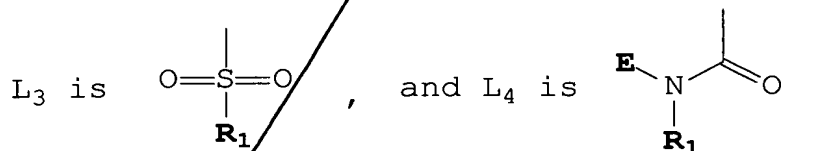
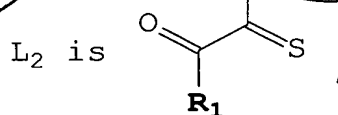
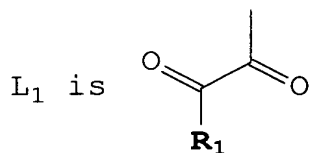
where

X, Y, and Z are independently selected from the group consisting of C, O, S, or N, provided that X, Y, and Z are not all C;

n is 1-3;

A is selected from the group consisting of L₁, L₂, L₃, or L₄,

where



R₁ and E are independently selected from the group consisting of hydrogen, C₁-C₉ straight or branched chain alkyl or alkenyl, C₂-C₉ straight or branched chain alkenyl, aryl, heteroaryl, carbocycle, and heterocycle;

D is selected from the group consisting of a bond, C₁-C₁₀ straight or branched chain alkyl, ethylene, and butylene;

R₂ is a carboxylic acid or a carboxylic acid isostere;

wherein said alkyl, alkenyl, alkynyl, aryl, heteroaryl, carbocycle, heterocycle, or carboxylic acid isostere is optionally substituted with one or more substituents selected from R³, where

R³ is hydrogen, hydroxy, halo, haloalkyl, thiocarbonyl, alkoxy, alkenoxy, alkylaryloxy, aryloxy, arylalkyloxy, cyano, nitro, imino, alkylamino, aminoalkyl, sulfhydryl, thioalkyl, alkylthio, sulfonyl, C₁-C₆ straight or branched chain alkyl, C₂-C₆ straight or branched chain alkenyl or alkynyl, aryl, heteroaryl, carbocycle, heterocycle, or CO₂R⁴ where R⁴ is hydrogen or C₁-C₉ straight or branched chain alkyl or alkenyl;
or a pharmaceutically acceptable salt, ester, or solvate thereof.

61. The method of claim 60, wherein R₂ is a carbocycle or heterocycle containing any combination of CH₂, O, S, or N in any chemically stable oxidation state, wherein any of the atoms of said ring structure are optionally substituted in one or more positions with R³.

62. The method of claim 60, wherein R₂ is selected from the following group:

The image displays a collection of chemical structures for various nucleobases and nucleosides. A large diagonal line is drawn across the center, crossing out several structures. The structures include:

- Purines:** Adenine (top left), Guanine (top center), Cytosine (top right), and Uracil (middle right).
- Pyrimidines:** Thymine (middle left), Cytosine (middle center), and Uracil (middle right).
- Nucleosides:** Adenosine (bottom left), Guanosine (bottom center), and Cytidine (bottom right).
- Other structures:** A structure with a carboxylic acid group (top left), a structure with a hydroxyl group (top center), a structure with a thiol group (top right), a structure with a carbonyl group (middle left), a structure with a carbonyl group (middle center), a structure with a carbonyl group (middle right), a structure with a carbonyl group (bottom left), a structure with a carbonyl group (bottom center), and a structure with a carbonyl group (bottom right).

where the atoms of said ring structure may be optionally substituted at one or more positions with R^3 .

63. The method of claim 60, wherein R_2 is selected from the group consisting of

-COOH, -SO₃H, -SO₂HNR³, -PO₂(R³)₂, -CN, -PO₃(R³)₂, -OR³, -SR³, -NHCOR³, -N(R³)₂, -CON(R³)₂, -CONH(O)R³, -CONHNH₂SO₂R³, -COHNSO₂R³, and -CONR³CN.

64. The method of claim 58, wherein the carboxylic acid or carboxylic acid isostere of an N-heterocyclic ring compound having two or more heteroatoms in the ring is selected from the group consisting of compounds 1-442, compound L, and compound M.

65. A pharmaceutical composition comprising:

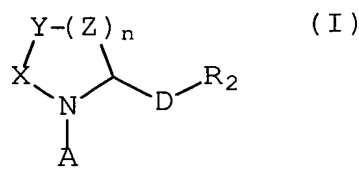
(i) an effective amount of a carboxylic acid or carboxylic acid isostere of an N-heterocyclic ring compound having two or more heteroatoms in the ring for treating alopecia or promoting hair growth in an animal; and

(ii) a pharmaceutically acceptable carrier.

66. The pharmaceutical composition of claim 65, wherein the carboxylic acid or carboxylic acid isostere of an N-heterocyclic ring compound having two or more heteroatoms in the ring is non-immunosuppressive.

67. The composition of claim 65, wherein the carboxylic acid or carboxylic acid isostere of an N-heterocyclic ring compound having two or more heteroatoms in the ring is a compound of formula (I):

0504238 120399



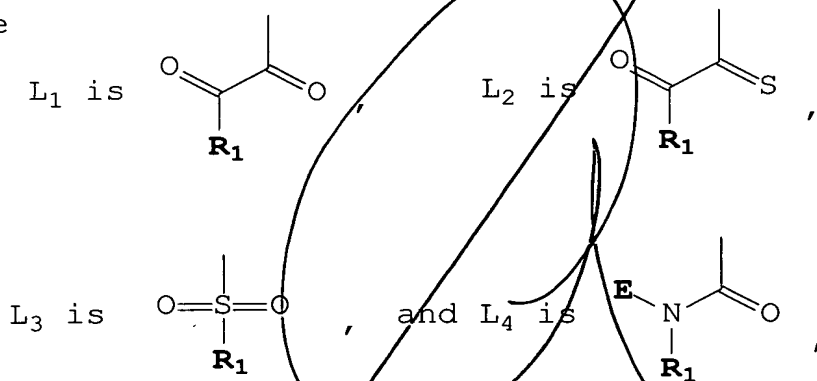
where

X, Y, and Z are independently selected from the group consisting of C, O, S, or N, provided that X, Y, and Z are not all C;

n is 1-3;

A is selected from the group consisting of L₁, L₂, L₃, or L₄,

where



R₁ and E are independently selected from the group consisting of hydrogen, C₁-C₉ straight or branched chain alkyl or alkenyl, C₂-C₉ straight or branched chain alkenyl, aryl, heteroaryl, carbocycle, and heterocycle;

D is selected from the group consisting of a bond, C₁-C₁₀ straight or branched chain alkyl, ethylene, and butylene;

R₂ is a carboxylic acid or a carboxylic acid isostere; wherein said alkyl, alkenyl, alkynyl, aryl, heteroaryl, carbocycle, heterocycle, or carboxylic acid isostere is optionally substituted with one or more substituents selected from R³, where

R³ is hydrogen, hydroxy, halo, haloalkyl, thiocarbonyl, alkoxy, alkenoxy, alkylaryloxy, aryloxy, arylalkyloxy, cyano, nitro, imino, alkylamino, aminoalkyl, sulfhydryl, thioalkyl, alkylthio, sulfonyl, C₁-C₆ straight or branched chain alkyl,

C₂-C₆ straight or branched chain alkenyl or alkynyl, aryl, heteroaryl, carbocycle, heterocycle, or CO₂R⁴ where R⁴ is hydrogen or C₁-C₉ straight or branched chain alkyl or alkenyl;

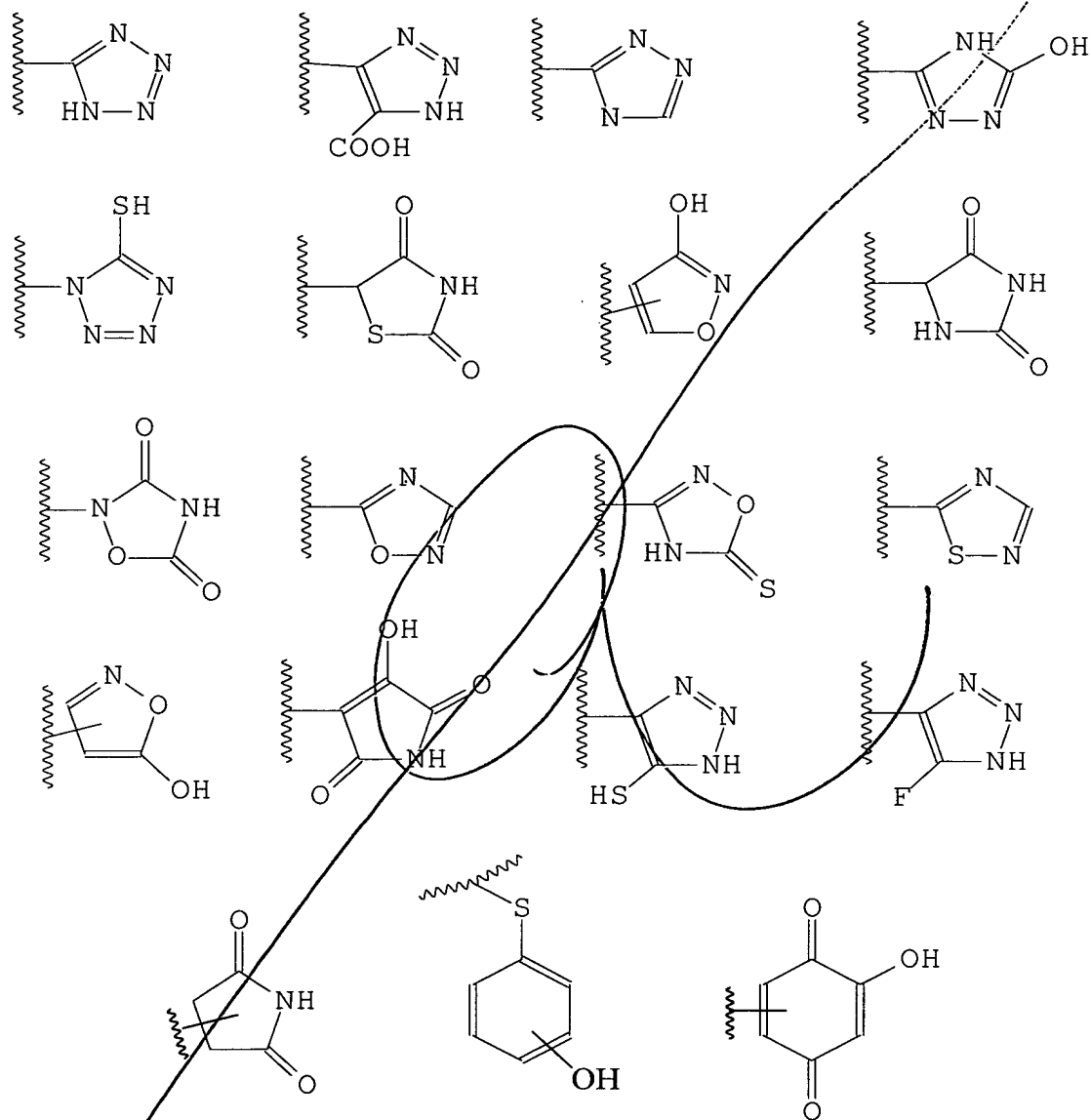
5 or a pharmaceutically acceptable salt, ester, or solvate thereof.

10 68. The composition of claim 67, wherein R₂ is a carbocycle or heterocycle containing any combination of CH₂, O, S, or N in any chemically stable oxidation state, wherein any of the atoms of said ring structure are optionally substituted in one or more positions with R³.

15 69. The composition of claim 67, wherein R₂ is selected from the following group:

09204238 120399
86E02T 8E24060

366031" 3E240260



where the atoms of said ring structure may be optionally substituted at one or more positions with R^3 .

70. The composition of claim 67, wherein R_2 is selected from the group consisting of:

-COOH, -SO₃H, -SO₂HNR³, -PO₂(R³)₂, -CN, -PO₃(R³)₂, -OR³, -SR³,
-NHCOR³, -N(R³)₂, -CON(R³)₂, -CONH(O)R³, -CONHNHSO₂R³,
-COHNSO₂R³, and -CONR³CN.

71. The composition of claim 65, wherein the carboxylic acid or carboxylic acid isostere of an N-heterocyclic ring compound having two or more heteroatoms in the ring is selected from the group consisting of compounds 1-442, compound L, and compound M.

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